

Having already determined A_I , we leave $N = 0$, if dA_{II} is in the same direction as dA_I ; otherwise we increment N by 1 and continue on to the next patch boundary.

E. SLOPE DISCONTINUITY

When our patches I and II are not tangent, we generate the elemental unit vectors at a point P on the boundary:

$$\begin{aligned} dS_I &= \frac{dU_I}{|dU_I|} \\ dT_I &= \frac{dW_I}{|dW_I|} \\ dR_{II} &= \frac{dU_{II}}{|dU_{II}|} \\ dQ_{II} &= \frac{dW_{II}}{|dW_{II}|} \end{aligned}$$

One of the elemental unit vectors of patch I will be parallel to that of patch II (the patches share a common boundary which is a coordinate of both patches). We then compare directions of these two vectors and store which vectors were parallel and whether they were in the same direction (store 0 or 1 in the sign index, N). The two remaining vectors must represent the coordinates of each patch running away or into the boundary -- not along the boundary. The values of the u or w coordinates (whichever ones are contained in the elemental unit vectors running away or into the boundary) are then called from the list structure. Since we are at either the 0 or 1 values of these coordinates, we call their values from the list structure and store a 0 if we are calling two u 's or w 's; otherwise, we store a 1. Comparing the values of these coordinates, we store a 1 if the values are the same; otherwise, we store a zero.

Our cross-product for the area vector on patch I was defined as $dU_I \times dW_I$. We now have sufficient information to have the cross-product of patch II yield an area vector in the correct direction. We will use the area equation on page 17 and increment N from its present value by the sum of the three values we have stored (their total can vary from 0 to 3). To demonstrate the above, we work the example shown in Fig. 3.

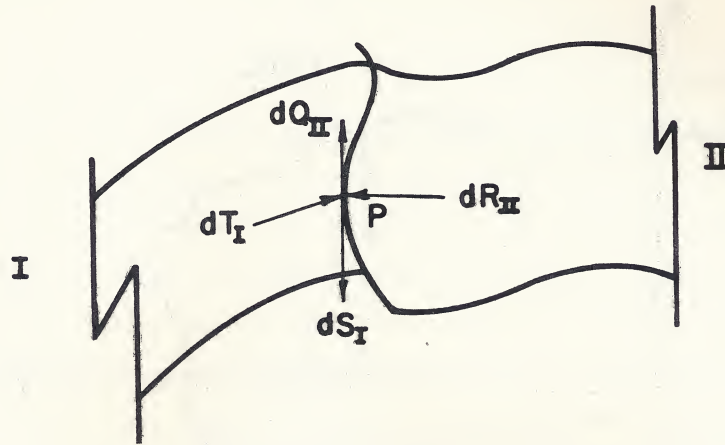


Fig. 3 Non-Tangent Surface Patches

- 1) comparing directions, dS_I is parallel to dQ_{II} , their direction is opposite, so $\alpha = 1$.
- 2) the two vectors left are dT_I , representing w_I and dR_{II} , representing U_{II} , since we have a w and a u , we set $\beta = 1$.
- 3) now $w_I = 1$ along boundary (dT_I points toward boundary) and $u_{II} = 1$, so $\gamma = 1$.
- 4) now $\alpha + \beta + \gamma = 3$ so that we are reversing the sign of dA_{II} in this case.

NOTE: $dU_I \times dW_I (dS_I \times dT_I)$ points out of paper and $-dU_{II} \times dW_{II} (-dR_{II} \times dQ_{II})$ points out of paper.

F. VOLUMES

Looking at a cross-section of our parametric surfaces (see Fig. 4), the volume of a small element with reference to the x, y plane may be represented as

$$dV = kz \cdot dA_z$$

or, with respect to the x, z and y, z planes, as

$$dV = jy \cdot dA_y$$

$$dV = ix \cdot dA_x$$